

## CLAIMS

We claim:

1           1.    A document image capture and processing system  
2 comprising:  
3           a document scanner for scanning a document and providing a  
4 digital image of information on the document to an image buffer;  
5           a document transport for transporting paper documents past  
6 the document scanner;  
7           a computer having a trend array for storing maximum values  
8 of scanner output as a document is scanned;  
9           trend analyzer logic in the computer for evaluating the  
10 maximum values in the trend array to determine a rate of scanner  
11 performance deterioration;  
12           maintenance projection logic in the computer responsive to  
13 the trend analyzer for projecting when maintenance will be  
14 required to retain system operating integrity; and  
15           monitor logic for receiving projected maintenance required  
16 for presentation to a system controller.

1           2.    The document image capture system of claim 1 further  
2 comprising:  
3           adjust logic in the computer for adjusting the maximum  
4 values of scanner picture element output in an initial row of the  
5 trend array after an interval to generate an adjusted maximum  
6 value for each scanner picture element;  
7           the adjust logic in the computer, adjusting a maximum  
8 picture element value by a larger amount when the maximum value  
9 of scanner picture element output indicates a return to  
10 acceptable performance by the scanning portion of the image  
11 system and adjusting a maximum picture element value by a smaller  
12 amount when the maximum value of scanner picture element output  
13 indicates a deterioration of acceptable performance by the

14 scanning portion of the image system.

1 3. The document image capture system of claim 2 further  
2 comprising:

3 trend array shift logic in the computer for shifting the  
4 adjusted maximum value of each scanner picture element output  
5 from the initial row of the trend array after an interval to an  
6 adjacent row in the trend array to generate a column of adjusted  
7 maximum values for each scanner picture element;

8 the trend analyzer logic responding to a slope of a rate of  
9 change of adjusted maximum values in a column of adjusted maximum  
10 values for a scanner picture element to generate a projection of  
11 when maintenance will be required.

12 4. The document image capture system of claim 1 further  
13 comprising:

14 a minimum trend array in the computer for storing minimum  
15 values of scanner output as a document is scanned;

16 the trend analyzer logic in the computer, evaluating the  
17 maximum values in the trend array and the minimum values in the  
18 minimum trend array to determine a rate of scanner performance  
19 deterioration.

20 5. The document image capture system of claim 1 further  
21 comprising:

22 image processor logic in the computer for processing  
23 information received from the image buffer;

24 interleave control logic in the computer for interleaving a  
25 test digital image of known information between digital images of  
26 information on documents in the image buffer;

27 comparator logic in the computer for comparing processed  
28 test image result information with expected result information to  
29 detect defects in image processing portions of the system;

30 the monitor logic receiving indications of defects detected

12 by the comparator and receiving the projected maintenance  
13 required for presentation to a system controller.

1 6. The document image capture system of claim 3 further  
2 comprising:  
3 image analyzer logic responsive to image data in the image  
4 buffer for analyzing each image to detect defects in image  
5 capture portions of the system;  
6 the monitor logic receiving indications of defects detected  
7 by the image analyzer and detected by the comparator and  
8 receiving the projected maintenance required for presentation to  
9 a system controller.

1 7. The document image capture system of claim 6 wherein  
2 the image analyzer logic further comprises:

3 a document centering detector for monitoring the document  
4 centering function of the document transport;

5 a document skew detector for monitoring the document  
6 aligning function of the document transport; and

7 a maximum video gradient detector for monitoring scanner  
8 picture element sensors and data path by detecting a maximum  
9 contrast of the digital image of information on the document in  
10 the image buffer.

1 8. Method for indicating operating integrity of a document  
2 image capture and processing system comprising steps of:

3 scanning a document and providing a digital image of  
4 information on the document to an image buffer;

5 transporting paper documents past the document scanner;

6 storing maximum values of scanner output in a computer trend  
7 array as a document is scanned;

8 evaluating the maximum values in the trend array to  
9 determine a rate of scanner performance deterioration;

projecting when maintenance will be required to retain system operating integrity from the rate of scanner performance deterioration; and  
presenting the projected maintenance required to a system controller.

9. Method of claim 8 further comprising steps of:  
adjusting the maximum values of scanner picture element output in an initial row of the trend array after an interval to generate an adjusted maximum value for each scanner picture element; and  
adjusting a maximum picture element value by a larger amount when the maximum value of scanner picture element output indicates a return to acceptable performance by the scanning portion of the image system and adjusting a maximum picture element value by a smaller amount when the maximum value of scanner picture element output indicates a deterioration of acceptable performance by the scanning portion of the image system.

10. Method of claim 9 further comprising steps of:  
shifting the adjusted maximum value of each scanner picture element output from the initial row of the trend array after an interval to an adjacent row in the trend array to generate a column of adjusted maximum values for each scanner picture element; and  
responding to a slope of a rate of change of adjusted maximum values in a column of adjusted maximum values for a scanner picture element to generate a projection of when maintenance will be required.

11. Method of claim 1 further comprising steps of:  
storing minimum values of scanner output in the trend array as a document is scanned; and

4 evaluating the maximum values in the trend array and the  
5 minimum values in the minimum trend array to determine a rate of  
6 scanner performance deterioration.

1 12. Method of claim 1 further comprising steps of:  
2 interleaving a test digital image of known information  
3 between digital images of information on documents in the image  
4 buffer;  
5 processing information received from the image buffer;  
6 comparing processed test image result information with  
7 expected result information to detect defects in image processing  
8 portions of the system; and  
9 presenting to the system controller, indications of defects  
10 detected.

11 13. Method of claim 10 further comprising step of:  
12 responding to image data in the image buffer by analyzing  
13 each image to detect defects in image capture portions of the  
14 system; and  
15 presenting indications of defects detected by the image  
16 analysis and detected by comparing to a system controller.

17 14. Method of claim 13 wherein the image analyzing step  
18 further comprises:  
19 monitoring the document centering function of the document  
20 transport;  
21 monitoring the document aligning function of the document  
22 transport; and  
23 monitoring scanner picture element sensors and data path by  
24 detecting a maximum contrast of the digital image of information  
25 on the document in the image buffer.

1 15. A program on a computer usable medium for indicating

2 operating integrity of a document image capture and processing  
3 system, the program on the computer usable medium comprising:

4       programmed logic means for comparing a value captured at  
5 each picture element during each scan line of an image with the  
6 value captured by the picture element during a preceding scan  
7 line to collect a maximum value captured by the picture element  
8 during scanning of the image;

9       programmed trend array logic means including a trend array  
10 for storing maximum values of scanner output as documents are  
11 scanned;

12       programmed trend analyzer logic means for evaluating the  
13 maximum values in the trend array to determine a rate of scanner  
14 performance deterioration;

15       programmed maintenance projection logic means responsive to  
16 the trend analyzer means for projecting when maintenance will be  
17 required to retain system operating integrity; and

18       programmed monitor logic means for receiving projected  
19 maintenance required for presentation to a system controller.

20  
21 16. The program of claim 15 further comprising:

22       programmed adjust logic means for adjusting the maximum  
23 values of scanner picture element output in an initial row of the  
24 trend array after an interval to generate an adjusted maximum  
25 value for each scanner picture element;

26       the programmed adjust logic means, adjusting a maximum  
27 picture element value by a larger amount when the maximum value  
28 of scanner picture element output indicates a return to  
29 acceptable performance by the scanning portion of the image  
30 system and adjusting a maximum picture element value by a smaller  
31 amount when the maximum value of scanner picture element output  
32 indicates a deterioration of acceptable performance by the  
33 scanning portion of the image system.

34  
35 17. The program of claim 16 further comprising:

2       programmed trend array shift logic means for shifting the  
3       adjusted maximum value of each scanner picture element output  
4       from the initial row of the trend array after an interval to an  
5       adjacent row in the trend array to generate a column of adjusted  
6       maximum values for each scanner picture element;

7       the programmed trend analyzer logic means responding to a  
8       slope of a rate of change of adjusted maximum values in a column  
9       of adjusted maximum values for a scanner picture element to  
10      generate a projection of when maintenance will be required.

1       18. The program of claim 15 further comprising:  
2       the programmed trend array logic means including a minimum  
3       trend array for storing minimum values of scanner output as  
4       documents are scanned; and

5       the programmed trend analyzer logic means, evaluating the  
6       maximum values in the trend array and the minimum values in the  
7       minimum trend array to determine a rate of scanner performance  
8       deterioration.

9       19. The program of claim 1 further comprising:  
10      programmed image processor logic means for processing  
11      information received from the image buffer;  
12      programmed interleave control logic means for interleaving a  
13      test digital image of known information between digital images of  
14      information on documents in the image buffer;  
15      programmed comparator logic means for comparing processed  
16      test image result information with expected result information to  
17      detect defects in image processing portions of the system;  
18      the programmed monitor logic means receiving indications of  
19      defects detected by the programmed comparator logic means and  
20      receiving the projected maintenance required for presentation to  
21      a system controller.

1           20. The program of claim 17 further comprising:  
2           programmed image analyzer logic means responsive to image  
3 data in the image buffer for analyzing each image to detect  
4 defects in image capture portions of the system;  
5           the programmed monitor logic means receiving indications of  
6 defects detected by the programmed image analyzer means and  
7 detected by the programmed comparator means and receiving the  
8 projected maintenance required for presentation to a system  
9 controller.

1           21. The program of claim 6 wherein the programmed image  
2 analyzer logic means further comprises:  
3           programmed document centering detector means for monitoring  
4 the document centering function of the document transport;  
5           programmed document skew detector means for monitoring the  
6 document aligning function of the document transport; and  
7           programmed maximum video gradient detector means for  
8 monitoring scanner picture element sensors and data path by  
9 detecting a maximum contrast of the digital image of information  
10 on the document in the image buffer.